

I – Problem Statement Title (EQ 014)

Assessment of Reliability and Durability of Seismic Response Modification Devices in service.

II – Research Problem Statement

Question: How can we monitor the long-term durability and integrity of installed Seismic Response Modification Devices reducing the need for removal from the bridges and periodical re-testing ?

Critical bridge structures were recently equipped with Seismic Response Modification Devices (SRMD). Their performance was tested during a large experimental program that was however limited to perfectly functional devices under a range of motions and forces consistent with their specific application. No specific information were collected, during this program, about the device performance in the long term and when in service. It is paramount for the bridge owners to anticipate any variation of device performance due to material degradation and change of in service conditions. An integrated tool for long term response prediction will re-define the terms of maintenance as “condition based” and will allow the integration with a general Structural Health Monitoring plan.

III – Objective

STAP Roadmap Outcome: 1. Improved Methods to Monitor and Assess The Performance of Existing Transportation Structures.

The first objective of this research is to develop an integrated tool for a long term SRMD response prediction. The development will require laboratory tests on material and on assembled devices. In addition to traditional tests, NDE investigations, based on active ultrasonic monitoring and passive acoustic emission monitoring to detect structural defects of the bearings will be used. Work should include the development of NDE protocols to target critical areas of the bearings, both in a routine-based maintenance mode and in a continuous monitoring mode, and the development of a database relating NDE signatures with the type, the size and the location of the structural defects.

In a second phase the predictions (material and structural response) provided by this tool will be validated with the present bridge response in order to account for peculiar conditions related to the specific bridge environment. Possible modification to the models will be implemented. In a final stage the tool will be integrated with Structural Health Monitoring plans under development (see Caltrans contract 59A0438).

IV – Background

Critical bridge structures as the Toll Bridges were retrofitted with the use of SRMD devices. The design and size of most of these devices are unprecedented and very little was researched on their characteristic degradation over time and as a function of environmental conditions.

V – Statement of Urgency, Benefits, and Expected Return on Investment

Some of the SRMDs installed on Caltrans bridges are shortly due for a detailed inspection of their performance characteristics after a certain period of service time. The only alternative to the proposed approach will be the removal of sample bearings from the bridge to be re-tested. This approach involves a significant cost and the acceptance of a period of time when the structure is potentially unprotected. It also implies an extrapolation of the results to the other devices installed, based on a limited number of tests.

VI – Related Research

The present research can complement and complete the research Project “Continuous Monitoring of the Performance of Isolated Bridges” sponsor by Caltrans as contract 59A0438.

VII – Deployment Potential

As a result of this research, degradation maps will be generated and integrated in a specific maintenance plan. The results will also be used as database for the general plan of SHM of isolated bridges.